



SWGAM Meeting
Fredericksburg, VA
July 16, 2015



Updates on Biology SAC, NCFS, and Recent NIST Activities

John M. Butler, Ph.D.

National Institute of Standards and Technology

NIST Fellow & Special Assistant to the Director for Forensic Science

Vice-Chair, National Commission on Forensic Science



Co-lead with DOJ

National Commission on Forensic Science

**NIST Point-of-Contact (POC):
John Butler**

A federal advisory committee for the U.S. Department of Justice

<http://www.justice.gov/ncfs>



Organization of Scientific Area Committees

POC: Mark Stolorow & John Paul Jones

NIST-administered effort dedicated to identifying and developing technically sound, consensus-based documentary standards and guidelines

<http://www.nist.gov/forensics/osac/>



NIST

Forensic Science

NIST Forensic Science Center of Excellence (announced May 2015)

Research Program

POC: Sue Ballou

SIX FOCUS AREAS

1. *Ballistics and Associated Tool Marks*
2. *Digital and Identification Forensics*
3. *Forensic Genetics*
4. *Toxins*
5. *Trace*
6. *Statistics*

<http://www.nist.gov/forensics>

NIST Research Efforts to Aid Forensic Science



SIX CURRENT FOCUS AREAS



1. Ballistics and Associated Tool Marks



2. Digital and Identification Forensics



3. Forensic Genetics



4. Toxins



5. Trace



6. Statistics

Internal NIST research will be supplemented by a new NIST Forensic Science Center of Excellence (FSCOE)

NIST Forensic Science Center of Excellence (FSCOE)

<http://www.nist.gov/coe/forensics/>

- NIST has committed to invest \$20M over 5 years in the FSCOE
- Goals: **(1) improve the statistical foundation for pattern evidence** (fingerprints, firearms, tool marks, etc.) **and digital evidence** (computer, video, and audio analyses) and **(2) develop education and training on probabilistic methods** for practitioners and other relevant stakeholders
- Timeline: Call for proposals (August 19, 2014), solicitation closed (December 11, 2014), award winners announced (May 25, 2015)
- Awardees: A consortium effort led by Iowa State involving Carnegie Mellon, University of California-Irvine, and the University of Virginia



Organization of Scientific Area Committees (OSAC)

Forensic discipline-specific “guidance groups”
administered by NIST



NIST
National Institute of
Standards and Technology
U.S. Department of Commerce

<http://www.nist.gov/forensics/osac/index.cfm>

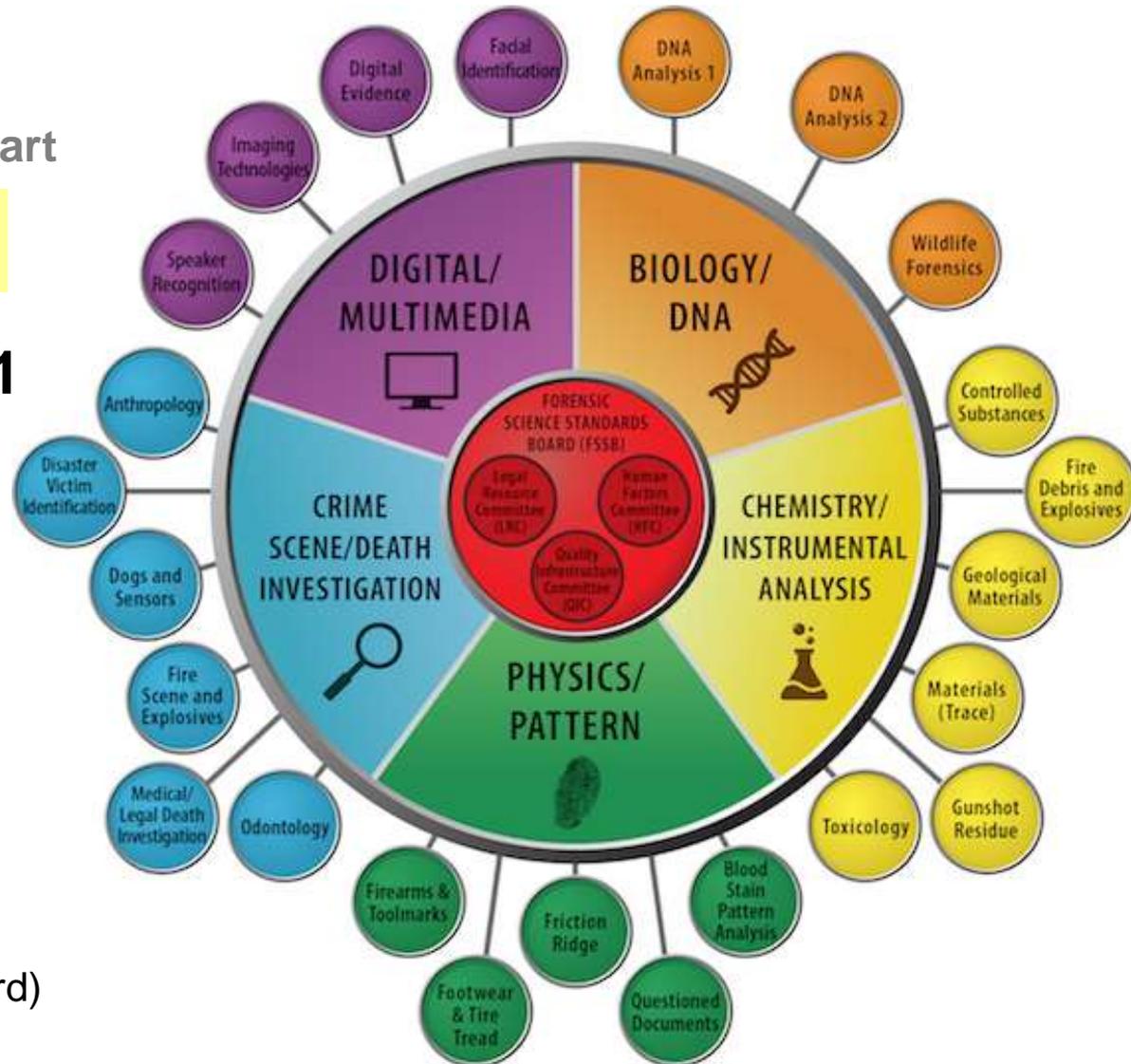
Organization of Scientific Area Committees

OSAC

Functional Organization Chart

Practice-focused

542 members and 131 affiliates (from >1300 eligible) as subject matter experts participating in >100 task groups, 24 subcommittees, 5 scientific areas, 3 resource committees (legal, quality, human factors), and 1 governing board (Forensic Science Standards Board)

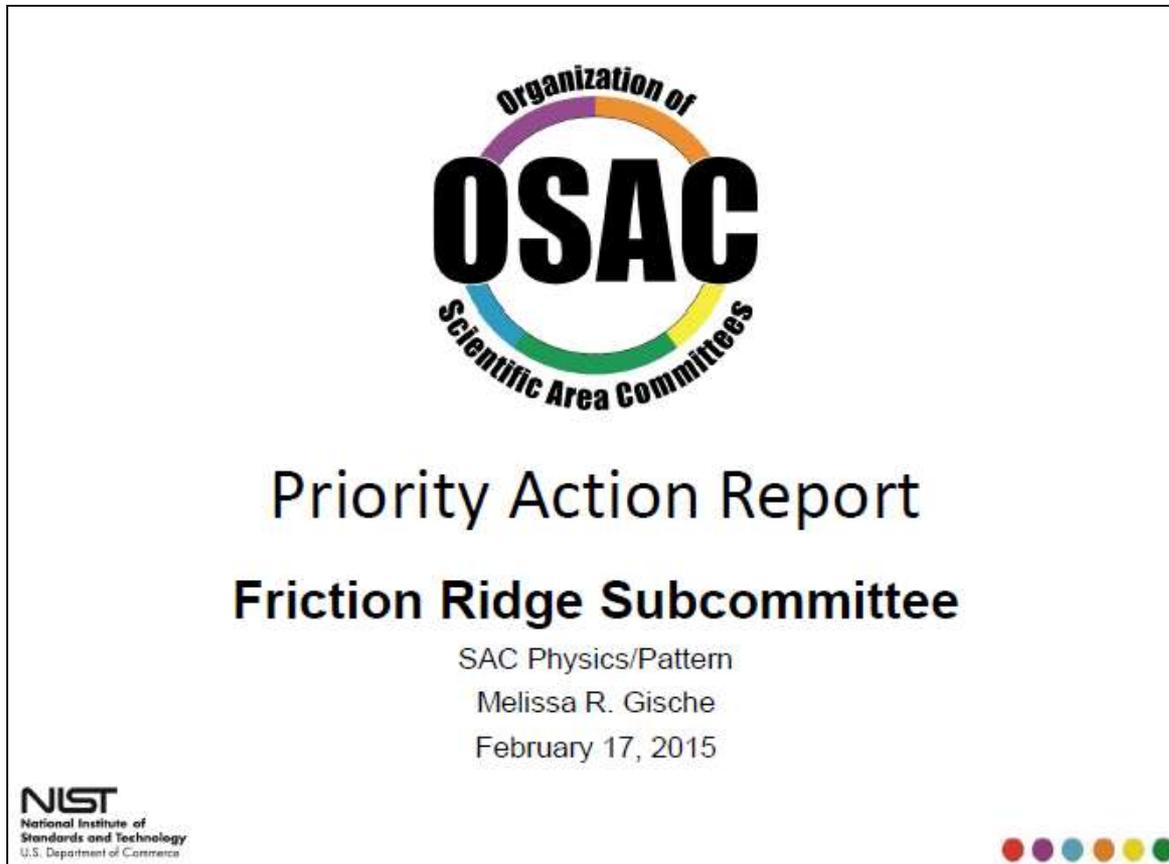


<http://www.nist.gov/forensics/osac/index.cfm>

Initial membership
finalized Dec 22, 2014

OSAC Scientific Area Committee Public Meetings held February 16-17, 2015 in Orlando, FL

1 of 30 presentations that can be downloaded



- This friction ridge subcommittee presentation contains 27 slides
- Reviews subcommittee leadership, membership, priority topics, and task groups

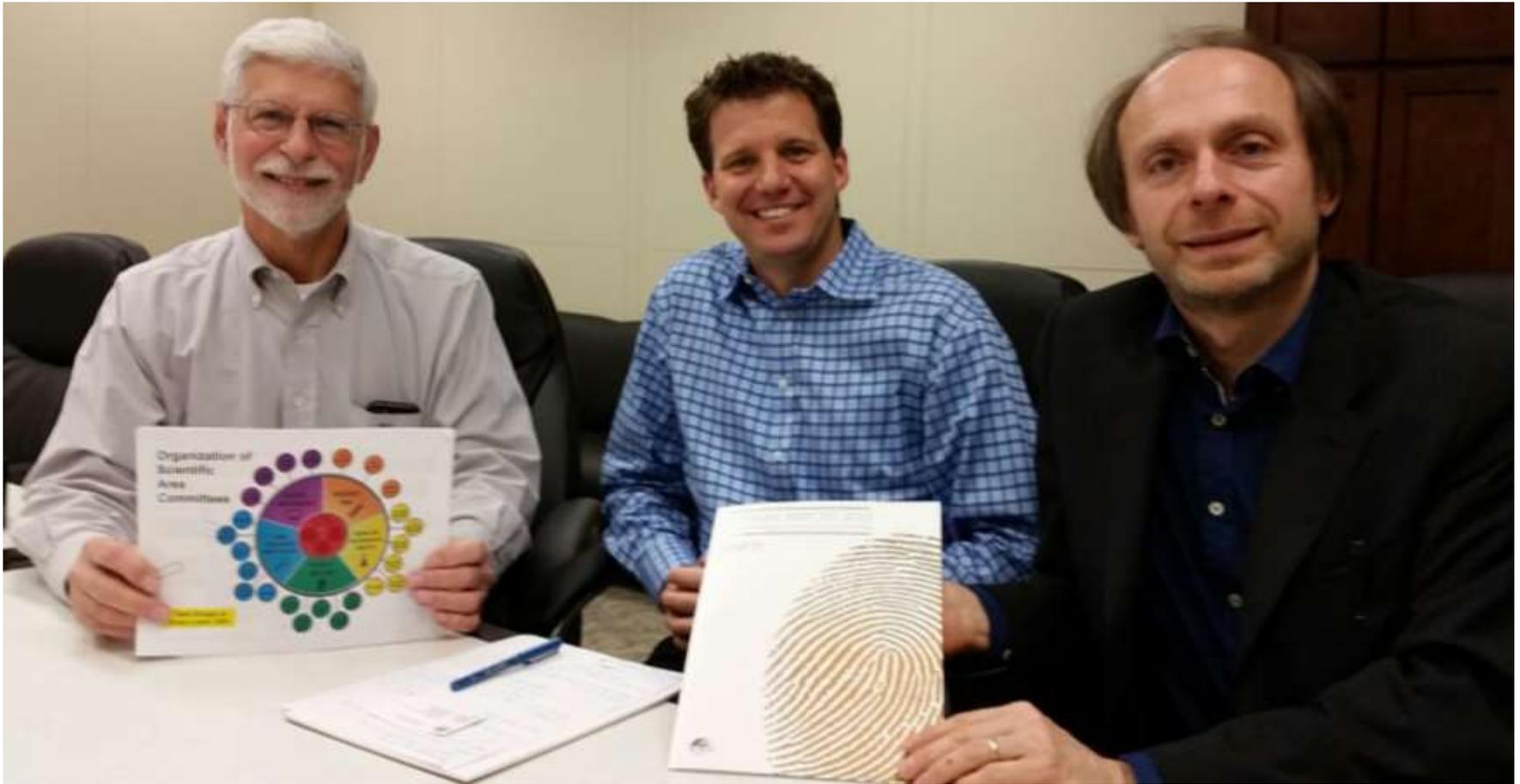
<https://workspace.forensicosac.org/kws/public>

OSAC and ENFSI Connect

Mark Stolorow (NIST)
Director of OSAC Affairs

John Paul Jones (NIST)
Deputy Director of OSAC Affairs

Jan de Kinder (Belgium)
ENFSI Chairman Designate



Dr. Jan de Kinder from the National Institute of Criminalistics and Criminology (Brussels, Belgium) visited NIST on March 18, 2015. He met with NIST OSAC leadership and discussed the Organization of Scientific Area Committees (OSAC) and how the European Network of Forensic Science Institutes (ENFSI) might interface with OSAC efforts. ENFSI has 64 member institutes, 2 standing committees, 17 working groups, and a 20 year history.



<http://www.nist.gov/forensics/osac/>

Governing Board has 17 members

[Forensic Science Standards Board \(FSSB\)](#)

3 [Resource Committees](#)

[Human Factors Committee](#) (HFC)

[Legal Resource Committee](#) (LRC)

[Quality Infrastructure Committee](#) (QIC)

[Committees](#) (5) and [Subcommittees](#) (24)

[Crime Scene/Death Investigation](#)

- [Anthropology](#)
- [Disaster Victim Identification](#)
- [Dogs and Sensors](#)
- [Fire Scene and Explosives](#)
- [Medical/Legal Death Investigation](#)
- [Odontology](#)

[Chemistry/Instrumental Analysis](#)

- [Controlled Substances](#)
- [Fire Debris and Explosives](#)
- [Geological Materials](#)
- [Gunshot Residue](#)
- [Materials \(Trace\)](#)
- [Toxicology](#)

[Digital/Multimedia](#)

- [Digital Evidence](#)
- [Facial Identification](#)
- [Imaging Technologies](#)
- [Speaker Recognition](#)

[Biology/DNA](#)

- [DNA Analysis 1](#)
- [DNA Analysis 2](#)
- [Wildlife Forensics](#)

[Physics/Pattern](#)

- [Bloodstain Pattern Analysis](#)
- [Friction Ridge](#)
- [Firearms/Toolmarks](#)
- [Footwear and Tire Tread](#)
- [Questioned Documents](#)



<http://www.enfsi.eu/>

[Governing Board](#) has 5 members

2 Standing Committees

[Quality & Competence Committee \(QCC\)](#)

[Research & Development Committee \(R&D\)](#)

17 Expert Working Groups

[Animal, Plant and Soil Traces](#)

[Digital Imaging](#)

[DNA](#)

[Documents](#)

[Drugs](#)

[Explosives](#)

[Fingerprint](#)

[Firearms/GSR](#)

[Fire and Explosions Investigation](#)

[Forensic Information Technology](#)

[Forensic Speech and Audio Analysis](#)

[Handwriting](#)

[Marks](#)

[Paint & Glass](#)

[Road Accident Analysis](#)

[Scene of Crime](#)

[Textile and Hair](#)

OSAC Interfaces with NIFS-Australia

Mark Stolorow
(Director of OSAC Affairs)

John Paul Jones
(Associate Director of OSAC Affairs)

Linzi Wilson-Wilde
(NIFS-Australia)

Karen Reczek
(OSAC Quality Infrastructure Committee Chair)

On April 22, 2015, Dr. Linzi Wilson-Wilde from the National Institute of Forensic Science in Melbourne, Australia visited NIST to meet with members of the OSAC planning team to discuss standards development in forensic science.

OSAC Quality Infrastructure Committee (QIC) has developed worksheets for documenting efforts

OSAC Technical Merit Worksheet



This worksheet is intended to assist in reviewing a potential standard or guideline to determine its appropriateness for inclusion on the OSAC Registries. Depending upon the nature of the standard or guideline, not all areas will be applicable. Additional factors may be needed for the evaluation of standards relating to observational- and judgment-based practices or human factors such as training, qualifications, research and quality control.

DATE: _____

CHAIR
Name: _____
Affiliation: _____
Email: _____
Phone: _____

- Document Title, Number, and Year:
- Are the purpose and scope of the document clearly defined?
 - Terminology
Are relevant terms, acronyms, and abbreviations defined?
 - Bibliographic Referencing
Does the document contain references to other documents?
 - Quality Control
Does the document describe the quality control process?
 - Is the document a test method or reporting guidelines, method, or procedure?

OSAC Harmonization Worksheet



This worksheet must be submitted with your Registry Request Form. The form is intended to assist in the evaluation of potential conflicts with documents currently listed on the OSAC Registries.

DATE: _____

CHAIR
Name: _____
Affiliation: _____
Email: _____
Phone: _____

Document Title, Number, and Year: _____

- Does the document contain any information that is currently listed on the OSAC Registry as conflicting or overlapping techniques or methods?
 - Yes
 - No (If "No", the form is complete)
- Name of conflicting or overlapping document: _____

OSAC Impact Worksheet



This worksheet must be completed and included with the Registry Request Form if the referenced document is likely to produce a financial, human resource, or other impact on the forensic community.

DATE: _____

CHAIR
Name: _____
Affiliation: _____
Email: _____
Phone: _____

Document Title, Number, and Year: _____

- What is the intended impact of the document, for example, is this standard or guideline intended for forensic scientists? _____

OSAC Standard Development Process Worksheet



Complete the following worksheet if the standard or guideline submitted for addition to the OSAC Registry was not developed by a recognized standards development organization (SDO) but might meet the process requirements. Provide all documentation to support the responses as attachments.

DATE: _____	SUBMITTING SUBCOMMITTEE: _____
CHAIR Name: _____ Affiliation: _____ Email: _____ Phone: _____	TECHNICAL CONTACT (If different than Chair) Name: _____ Affiliation: _____ Email: _____ Phone: _____

Document Title, Number, and Year: _____

- Was a written procedure used to govern the creation of this standard or guideline?
 - Yes
 - No (If "No", describe below)

OSAC Registry Approval Process

issued by the FSSB on July 1, 2015



OSAC Standards/Guidelines Registry Approval Process Description

This process begins with a standard or guideline that an Organization of Scientific Area Committees (OSAC) Subcommittee has deemed to be technically sound (via a Technical Merit Rating of 1 or 2 on the ***Quality Infrastructure Committee [QIC] Form 1: Technical Merit Worksheet***), and that the Subcommittee QIC liaison has confirmed to be either developed through an established standards development organization (SDO) or through another approved process (***QIC Form 2: Standards Development Process Worksheet***).

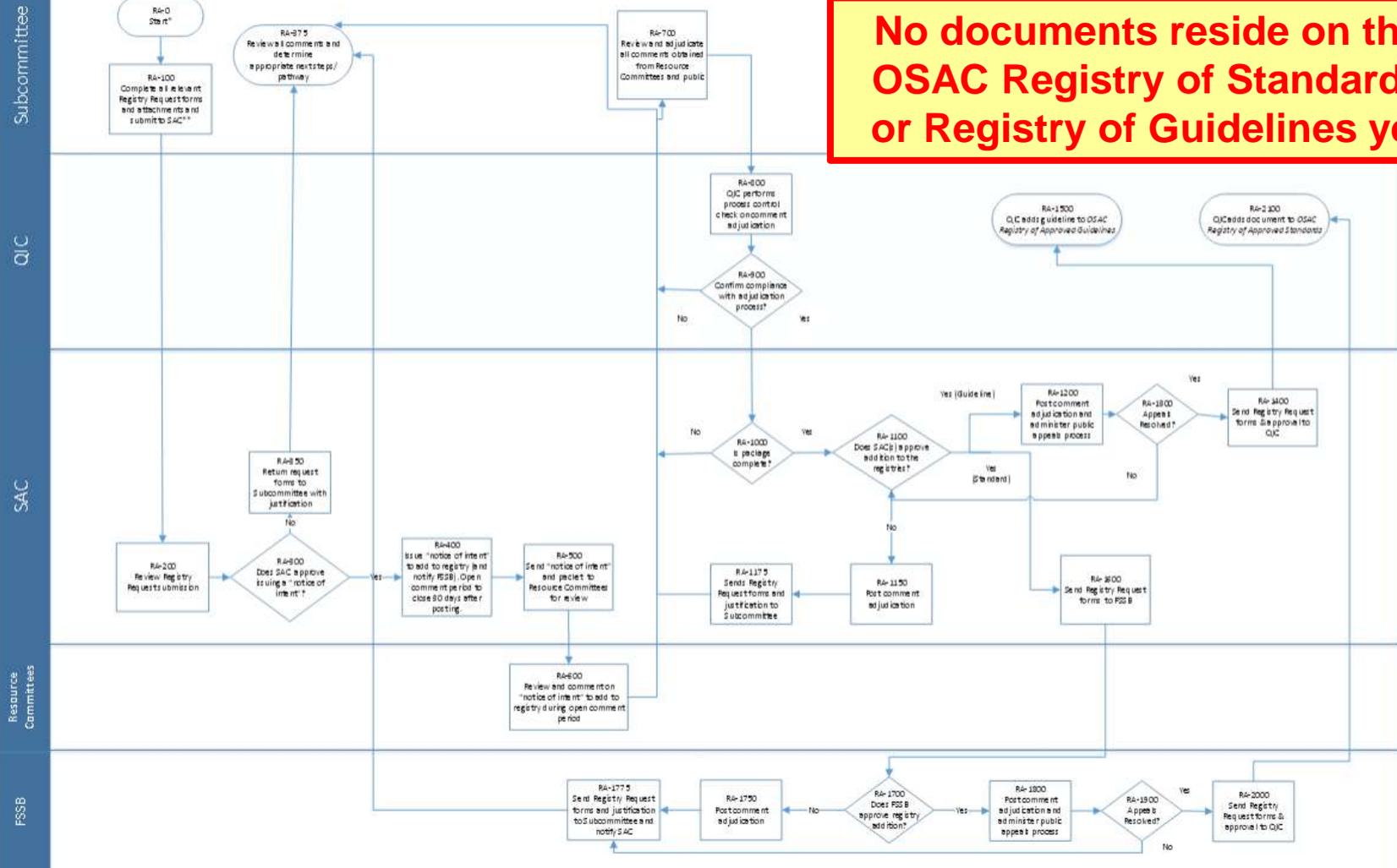
RA-0 OSAC Subcommittees may recommend standards or guidelines to be added to the *OSAC Registry of Approved Standards* or the *OSAC Registry of Approved Guidelines*.

Process Map for OSAC Registry Approval

OSAC Registry Approval Process of Published Standards/Guidelines Process Map

Registry Approval Process Map

No documents reside on the OSAC Registry of Standards or Registry of Guidelines yet



** Begin with a standard or guideline that the subcommittee has deemed to be technically sound (QIC Form 1), and that the subcommittee QIC liaison has confirmed to be developed through an approved standards development organization or an approved process (QIC Form 2).

** Forms include 1) QIC Form 1: Technical Merit Worksheet 2) QIC Form 2: Standards Development Process Worksheet (if applicable) 3) QIC Form 3: Registry Request 4) QIC Form 4: Impact Worksheet 5) QIC Form 5: Harmonization Worksheet.

Version 1 / Date of Issue: 7.1.2015 / Document Owner: Quality Infrastructure Committee (QIC) / Issuing Authority: Forensic Science Standards Board (FSSB)

SAC Biology Membership and Initial Terms (2, 3, or 4 years)

Members (Term)	Role
George Herrin (4)	Chair
Angelo Della Manna (3)	Vice-Chair
DeeDee Hawk (2)	Ex Sec
Kim Murga (2)	SC Chair
Robyn Ragsdale (4)	SC Chair
Kathy Moore (2)	SC Chair

Members (Term)	Role
John Butler (3)	QIC Liaison, SWGDM Liaison
Tom Callaghan (3)	
Robin Cotton (4)	LRC Liaison
Phillip Danielson (4)	HFC Liaison
Bruce Weir (3)	
<i>TBD Statistician</i>	

First public SAC meeting was held **February 16, 2015 7-10pm** at the AAFS meeting
 Monthly conference calls are conducted to get subcommittee updates

Next public SAC meeting will be **October 15, 2015 7:30-8:45am** at the ISHI meeting

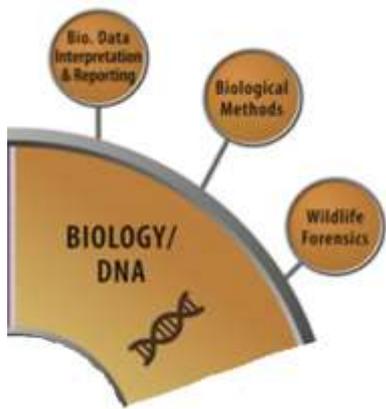
Orlando hotel burning...



July 5, 2015 – Avanti Hotel caught fire due to a lightning strike



Some SAC Biology members stayed here February 15-16, 2015



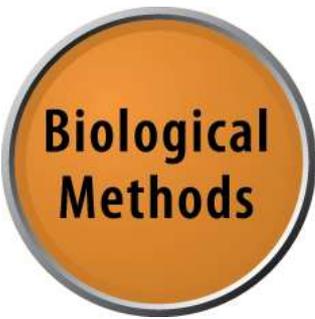
Biology/DNA Scientific Area Committee

3 SWGDAM participants



George Herrin
(chair)

Not pictured: Bruce Weir



OSAC Biological Methods Subcommittee

Formerly known as "DNA 1"

6 SWGDAM participants



Kim Murga
(chair)

Not pictured. Eugene Lien.
Amy McGuckian



OSAC Biological Data Interpretation and Reporting Subcommittee

Formerly known as "DNA 2"

7 SWGDAM participants



Not pictured: Tim McMahon

Robyn Ragsdale
(chair)



OSAC Wildlife Forensics Subcommittee



3 members not pictured

Kathy Moore
(chair)

SAC Biology/DNA Activity

Task Groups

Terminology (Buel)

Validation/Method (Weitz)

Education/Training (Press)

Sample Id & Collection (Zervos)

Terminology (Westring)

Statistical Interpretation (Zabell)

Probabilistic Genotyping (Sutton)

Software Validation (Kehl)

Mixture Interp Verification (Sobieralski/Montpetit)

Terminology (Baker/Hoofer)

Standards and Guidelines (O'Brien/Giles)

Report Writing (Trail/Giles)

Validation (Lindquist/Hoofer)

Subcommittees

Biological Methods (Murga)

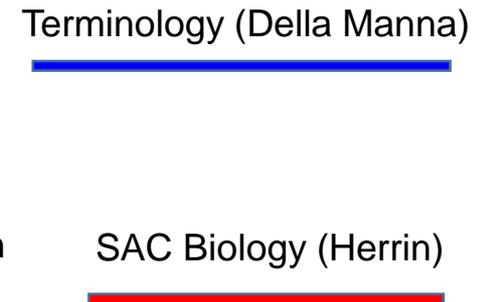
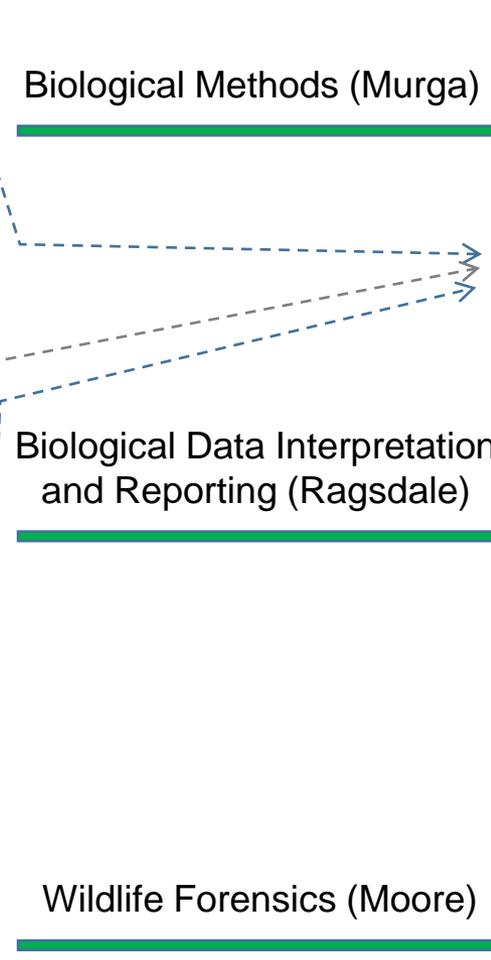
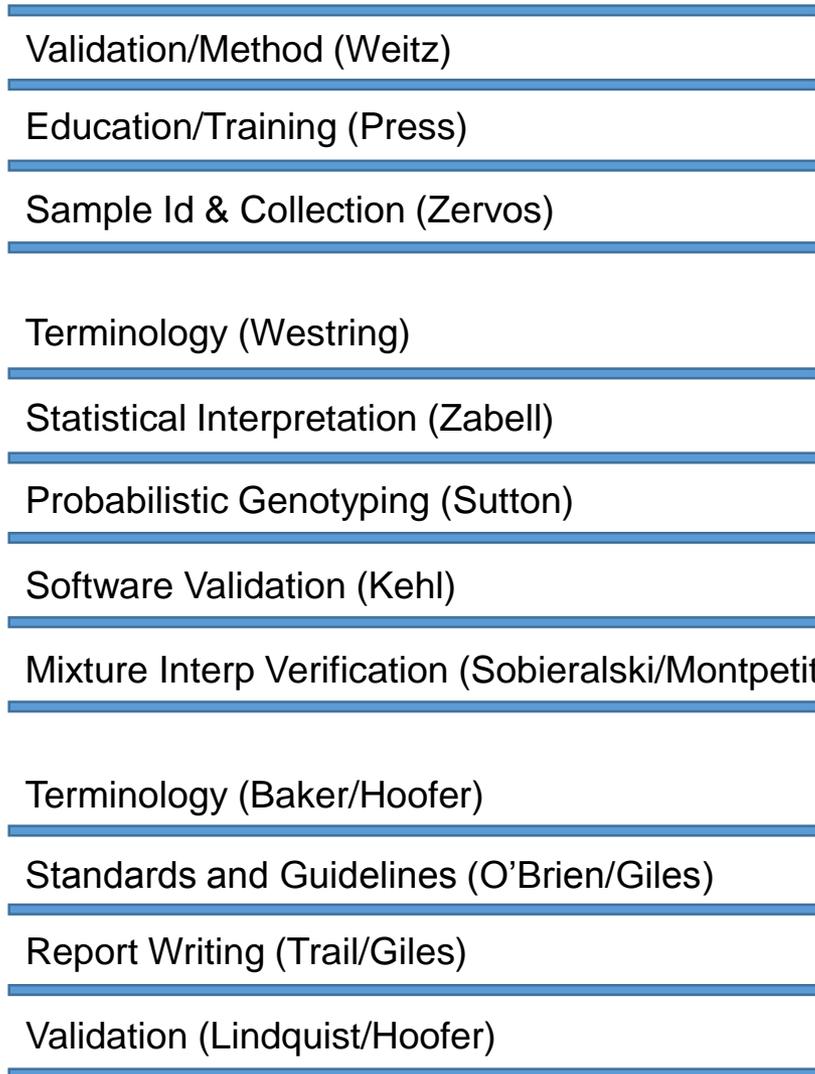
Biological Data Interpretation
and Reporting (Ragsdale)

Wildlife Forensics (Moore)

Biology/DNA Scientific Area Committee

Terminology (Della Manna)

SAC Biology (Herrin)



OSAC Biology/DNA SAC Summary

- A public SAC meeting/public comment session will occur as part of the ISHI meeting in Grapevine, Texas on October 15, 2015
- A number of documents are expected to be completed by the end of this year for submission to a Standards Developing Organization (SDO)
- If AAFS is able to stand up their SDO process by early 2016, then this is probably the route that the Biology SAC will use
- How to best handle QAS documents going through an SDO process for inclusion on the OSAC Registry is still under discussion with the FBI & SWGDAM Chair

National Commission on Forensic Science

A Federal Advisory Committee
for the U.S. Department of Justice



U.S. Department of Commerce

<http://www.justice.gov/ncfs>

National Commission on Forensic Science (NCFS)

www.justice.gov/ncfs

Policy-focused

NCFS Leadership

In 2013, the Department of Justice (DOJ) established the National Commission on Forensic Science, in partnership with the National Institute of Standards and Technology (NIST), to enhance the practice and improve the reliability of forensic science. This unique partnership draws upon each agency's core strengths to promote scientific validity, reduce fragmentation, and improve federal coordination of forensic science.

The Commission is co-chaired by Deputy Attorney General James M. Cole and NIST Acting Director and Acting Under Secretary of Commerce for Standards and Technology, Willie E. May. Nelson Santos, Deputy Assistant Administrator for the Office of Forensic Sciences at the Drug Enforcement Administration, and John M. Butler, Special Assistant to the NIST Director for forensic science, serve as vice-chairs. Brette Steele, Senior Advisor on Forensic Science and Senior Counsel to the Deputy Attorney General serves as the Designated Federal Officer and Robin Jones, Consultant within the Department of Justice, serves as Program Manager.

The Commission includes federal, state and local forensic science service providers; research scientists and academics; law enforcement officials; prosecutors, defense attorneys and judges; and other stakeholders from across the country.

GENERAL INFORMATION
NATIONAL COMMISSION ON FORENSIC SCIENCE

CONTACT

Brette Steele
Brette.L.Steele@usdoj.gov

By Phone:
(202) 305-0180

32 voting and 8 *ex-officio* members

Last meeting (6th): April 30-May 1, 2015

Next meeting (7th): August 10-11, 2015



Sally Q. Yates
Deputy Attorney General
DOJ Co-Chair



Willie E. May
Director of NIST
NIST Co-Chair



Nelson A. Santos
Vice-Chair (DOJ)



John M. Butler
Vice-Chair (NIST)

Current NCFS Subcommittees

<http://www.justice.gov/ncfs/subcommittees>

where much of the Commission work occurs...

NCFS Subcommittee	# Commissioners	# Non-Commissioners
1. Accreditation & Proficiency Testing	7	15
2. Human Factors & Cognitive Bias	5	13+1
3. Interim Solutions	12	2
4. Medico-legal Death Investigation	6	9
5. Reporting & Testimony	13	8
6. Scientific Inquiry & Research	12	3
7. Training on Science & Law	8	6

Most Commissioners are on multiple subcommittees

57 non-Commissioners contributing to the process

Subcommittee products are discussed and voted on by the full Commission prior to be recommended to the Attorney General

Timeline for Commission Activities

SWGDM talk (January 9, 2014)

- Commission membership named (January 10, 2014)
- *First* Commission meeting (February 3-4, 2014)
- *Second* Commission meeting (May 12-13, 2014)

SWGDM talk (July 17, 2014)

- *Third* Commission meeting (August 26-27, 2014)
- ISHI meeting presentation (October 1, 2014)
- World Forensics Festival talk (October 14, 2014)
- *Fourth* Commission meeting (October 28-29, 2014)

SWGDM talk (January 15, 2015)

- *Fifth* Commission meeting (January 29-30, 2015)
- *Sixth* Commission meeting (April 30-May 1, 2015)

SWGDM talk (July 16, 2015)

- *Seventh* Commission meeting (August 10-11, 2015)
- *Eighth* Commission meeting (December 7-8, 2015)

**Federal Advisory
Committees exist on a
2-year renewal cycle**

**New Commission
charter signed on
April 23, 2015**

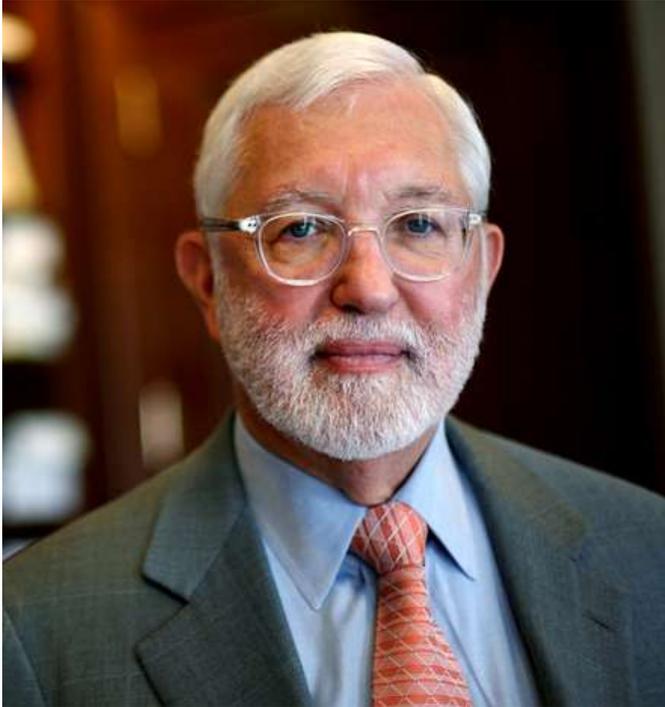
**Includes digital
evidence**

January 29, 2015 Commission Excitement

THE WALL STREET JOURNAL

Federal Judge Quits Panel Over Proposed Evidence Rules

- By **DEVLIN BARRETT** Updated Jan. 29, 2015 7:25 p.m. ET
- Calls Decision to Limit Trials' Discovery Phase 'Unsupportable'
- WASHINGTON—A prominent federal judge resigned in protest from a committee advising the Justice Department on the use of scientific evidence after department officials decided the group couldn't examine how such evidence is made available before a trial.



Judge Jed Rakoff

Federal Judge, Southern District of New York
Ex-officio member of the NCFS

January 30, 2015 Commissioner Returns



The Washington Post

Judge Rakoff returns to forensic panel after Justice Department backs off decision

By Spencer S. Hsu January 30

A federal judge Friday returned to a presidential commission on forensic science after the U.S. Justice Department reversed a decision to bar the panel from discussing changes that would give criminal defendants more information about forensic evidence before their trials, a federal official said.

U.S. District Judge Jed S. Rakoff of the Southern District of New York had resigned in protest Wednesday from the Obama administration panel, accusing the department of placing “strategic advantage [for prosecutors] over a search for the truth.”

However, Acting U.S. Deputy Attorney General Sally Q. Yates invited Rakoff to return, saying she had not been aware the commission had worked openly on its plans for nearly a year.

NCFS Meeting 5 Topics

January 29-30, 2015

- **Subcommittee Reports & Work Product Discussion**
 - **Four final work products discussed; three were approved**
- Update on Bureau of Justice Statistics law enforcement agency forensic unit survey plans (Speaker: Erica Smith)
- **Panel on** documentary standards
 - Speakers: Gordon Gillerman, Warren Merkel, Karen Reczek
- **Panel on** judicial training
 - Speakers: Katheryn Yetter, Judge Jeremy Fogel, Judge Mark Atkinson
- **Presentation on** accreditation and certification within the MDI community
 - Speaker: Steven Clark

The Letter Writing Campaign and a New Charter for the Commission

- In February and March 2015, DAG Sally Yates and NIST Director Willie May received letters from several Commissioners requesting specific process improvements in the operation of the National Commission on Forensic Science
- DOJ leadership changes, Senate confirmation hearings for the DOJ and NIST co-chairs, and deadlines for charter renewal...
- The first two-year term of the Commission concluded on April 23, 2015 – and **another two-year charter was signed** (one of the last things Eric Holder did as Attorney General)

NCFS Meeting 6 Topics

April 30-May 1, 2015

- **Subcommittee Reports & Work Product Discussion**
 - **Three final work products were approved**
- Discussion of Federal Advisory Committee Act and Commission governance topics → **a Bylaws Subcommittee was formed**
- **Panel on Evidence Preservation and Retention**
 - Speakers: Greg Matheson, Steve Campbell, Cynthia Jones, Shannan Williams
- **Panel on OSAC Update and Priority Action Report**
 - Speakers: Jeremy Triplett, George Herrin, Scott Oulton, Greg Davis, Richard Vorder Bruegge, Austin Hicklin
- **Presentation on disaster victim identification within the MDI community**
 - Speaker: Frank DePaolo

New Designated Federal Official for the National Commission on Forensic Science



Andrew J. Bruck

Andrew J. Bruck
Counsel to the Deputy Attorney General
950 Pennsylvania Avenue NW
Washington, DC 20530
Andrew.J.Bruck@usdoj.gov
(202) 305-3481

New Bylaws Subcommittee

- **Purpose:** to define/refine process documents and bylaws governing Commission activities
- **Membership:**
 - DFO: Andrew Bruck
 - Vice-Chairs: Nelson Santos & John Butler
 - OSTP representative: Tania Simoncelli
 - Commission representatives (4):
 - Marilyn Huestis (researcher)
 - Dean Gialamas (practitioner)
 - Pam King (defense attorney)
 - Matt Redle (prosecuting attorney)



Posted April 28, 2015

Notice

National Commission on Forensic Science Notice of Charter Renewal and Solicitation of Applications for Additional Commission Membership

A Notice by the Justice Department on 04/28/2015



49 applicants before solicitation closed on May 28, 2015
6 positions in the process of being filled
(5 who left the NCFS + 1 digital evidence slot)

SUMMARY

In accordance with title 41 of the U.S. Code of Federal Regulations, section 102-3.65(a), notice is hereby given that the Charter for the National Commission on Forensic Science was renewed for an additional two-year period on April 23, 2015. The Attorney General has determined that the National Commission on Forensic Science is necessary and in the public interest in connection with the performance of duties of the Department of Justice and these duties can best be performed through the advice and counsel of this group.

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PUBLIC INSPECTION

Publication Date:
Tuesday, April 28, 2015

Agency:
Department of Justice

Documents Approved by the Commission

- Aug 2014** 1. Survey of law enforcement forensic units (directive)
- Jan 2015** 2. Accreditation of Medical Examiner and Coroner Offices (policy)
- Jan 2015** 3. Certification of Medicolegal Death Investigators (directive)
- Jan 2015** 4. Scientific Literature in Support of Forensic Science and Practice (views)
- Apr 2015** 5. Inconsistent Terminology (views)
- Apr 2015** 6. Universal Accreditation (policy)
- May 2015** 7. Forensic Science and Related Terms (views)

Awaiting notice of Attorney General acceptance of the approved documents

Potential Documents Up for a Vote

(after discussion at the April 30 – May 1, 2015 meeting)

1. Pretrial Discovery of Forensic Materials (views)
2. Testimony using the Term “Reasonable Scientific Certainty” (views)
3. Automated Fingerprint Identification System (AFIS) Interoperability (directive)
4. National Code of Ethics and Professional Responsibility for the Forensic Sciences (directive)
5. Root Cause Analysis (RCA) in Forensic Science (directive)
6. Increasing the Number, Retention and Quality of Board Certified Forensic Pathologists (policy)
7. Electronic Networking of Medical Examiner and Coroner Offices in the United States (policy)

**Public comment received
from April 15 to May 15**

Recent NIST Activities in Forensic Science

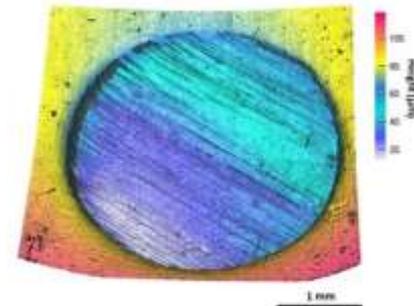
- NIST/NIJ meetings held since January 2015
- NIST Forensic Science Center of Excellence (May 25)
- NIST Error Management Conference (July 21-24)
- My AAFS Feb 2015 talk on DNA interpretation
- Two recent articles published
 - The future of forensic DNA analysis. *Phil. Trans. R. Soc. B.*
 - U.S. initiatives to strengthen forensic science & international standards in forensic DNA. *FSI Genetics*
- *FSI Genetics* Special Issue
 - Vol. 18, New Trends in Forensic Genetics
 - Introduction plus 13 invited review articles
- Wilmer Souder research & history of forensic science

Recent Forensic Conferences Held at NIST in Collaboration with NIJ



January 26-27, 2015

**Forensic Optical
Topography Meeting**
(with NIJ and RTI International)



March 17-18, 2015

Meeting Metrics

FORENSIC SCIENCE
ERROR MANAGEMENT
INTERNATIONAL
FORENSICS SYMPOSIUM
JULY 20-24, 2015 • WASHINGTON, DC



http://www.nist.gov/director/international_forensics_home.cfm

- **More than 375 people have registered from at least 35 states and 10 additional countries**
- 2 keynote speakers (Brandon Mayfield & Steven Wax)
- 8 world-renowned plenary speakers
- 42 sessions across 8 technical tracks
 - **105 individual platform presentations**
 - **9 panels**
- **19 poster presentations** (on display Tues, Wed, Thurs)
- Symposium will close on Friday with a **moot court presentation**



American Academy of Forensic Sciences
Jurisprudence Section
Orlando, FL
February 20, 2015



ORLANDO 2015

http://www.cstl.nist.gov/strbase/pub_pres/Butler-DNA-interpretation-AAFS2015.pdf

Why DNA Interpretation Has Become More Challenging in Recent Years

John M. Butler, Ph.D.

NIST Fellow & Special Assistant to the Director for Forensic Science
National Institute of Standards and Technology
Gaithersburg, Maryland



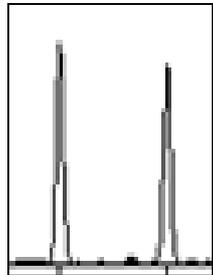
5 Reasons that DNA Results Are Becoming More Challenging to Interpret

1. **More sensitive DNA test results**
2. **More touch evidence samples** that are poor-quality, low-template, complex mixtures
3. **More options exist** for statistical approaches involving probabilistic genotyping software
4. **Many laboratories are not prepared** to cope with complex mixtures
5. **More loci being added** because of the large number of samples in DNA databases

Math Analogy to DNA Evidence

$$2 + 2 = 4$$

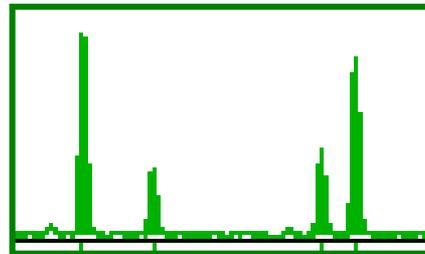
Basic Arithmetic



**Single-Source
DNA Profile**
(DNA databasing)

$$2x^2 + x = 10$$

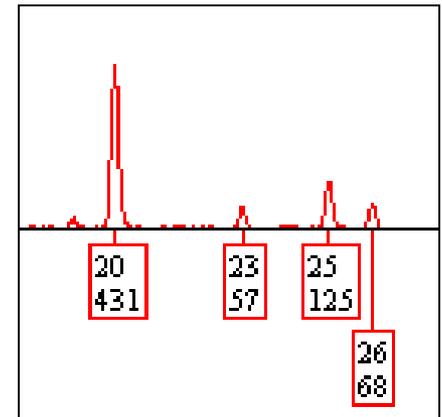
Algebra



Sexual Assault Evidence
(2-person mixture with
high-levels of DNA)

$$\int_{x=0}^{\infty} f(x) dx$$

Calculus



Touch Evidence
(>2-person, low-level,
complex mixtures
perhaps involving
relatives)

From a Royal Society Meeting Held in London on February 2-3, 2015

PHILOSOPHICAL
TRANSACTIONS B

rstb.royalsocietypublishing.org



Opinion piece

Cite this article: Butler JM. 2015 The future of forensic DNA analysis. *Phil. Trans. R. Soc. B* **370**: 20140252.

<http://dx.doi.org/10.1098/rstb.2014.0252>

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One contribution of 15 to a discussion meeting issue 'The paradigm shift for UK forensic science'.

The future of forensic DNA analysis

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The author's thoughts and opinions on where the field of forensic DNA testing is headed for the next decade are provided in the context of where the field has come over the past 30 years. Similar to the Olympic motto of 'faster, higher, stronger', forensic DNA protocols can be expected to become more rapid and sensitive and provide stronger investigative potential. New short tandem repeat (STR) loci have expanded the core set of genetic markers used for human identification in Europe and the USA. Rapid DNA testing is on the verge of enabling new applications. Next-generation sequencing has the potential to provide greater depth of coverage for information on STR alleles. Familial DNA searching has expanded capabilities of DNA databases in parts of the world where it is allowed. Challenges and opportunities that will impact the future of forensic DNA are explored including the need for education and training to improve interpretation of complex DNA profiles.

<https://royalsociety.org/events/2015/02/forensic-science/>

Thoughts on the Future of Forensic DNA Analysis

Table 2. Current practice and future potential for genetic markers used in forensic DNA analysis.

marker	current practice (as of 2014)	future potential
autosomal STRs	core loci used to create DNA profile databases and to perform casework; data generated in laboratories with CE systems	expanded core set of loci enabling more international comparisons; data generated by NGS
Y-chromosome STRs	casework examination of 12–27 Y-STR loci with haplotype frequencies searched in population databases (e.g. YHRD.org); familial searching candidate pool restricted with Y-STR screening	larger population databases to improve haplotype frequency estimates; genetic genealogy database information combined with Y-STR casework data to help provide potential surname of perpetrator in some cases; rapidly mutating Y-STRs used to separate close male relatives
X-chromosome STRs	population data collected for 12+ loci but only used occasionally in kinship cases	X-STRs and X-SNP markers routinely used to help address challenging kinship questions with testing performed on NGS platform in parallel with autosomal STRs
mitochondrial DNA	control region Sanger sequencing with haplotype frequencies estimated through population database searches (e.g. EMPOP.org)	full mtGenome by NGS to produce the highest resolution possible; larger population databases to improve haplotype frequency estimates
bi-allelic markers (SNPs and InDels)	a few dozen SNPs examined with multiple SNaPshot assays on CE platforms for simple phenotype or biogeographic ancestry prediction; some population data collected with insertion/deletion (InDel) assays	hundreds of SNPs or InDels for biogeographic ancestry and phenotype predictions tested on NGS platform in parallel with STRs

Articles in this Special Issue from the Royal Society

Author	Title <i>Phil. Trans. R. Soc. B; August 2015; volume 370, issue 1674</i>
Black, Nic Daeid	Time to think differently: catalyzing a paradigm shift in forensic science
Lord CJ Thomas	The legal framework for more robust forensic science evidence
O'Brien, Nic Daeid, Black	Science in the court: pitfalls, challenges and solutions
Paul Roberts	Paradigms of forensic science and legal process: a critical diagnosis
Bolliger & Thali	Imaging and virtual autopsy: looking back and forward
Anil Jain & Arun Ross	Bridging the gap: from biometrics to forensics
Christophe Champod	Fingerprint identification: advances since the 2009 National Research Council report
John Butler	The future of forensic DNA analysis
Claude Roux et al.	The end of (forensic science) world as we know it? The example of trace evidence
Ken Furton et al.	Advances in the use of odour as forensic evidence through optimizing and standardizing instruments and canines
Tetty & Crean	New psychoactive substances: catalyzing a shift in forensic science practice?
Ian Evett	The logical foundations of forensic science: towards reliable knowledge
Arian van Asten et al.	The interface between forensic science and technology...
Alastair Ross	Integrating research into operational practice
Itiel Dror	Cognitive neuroscience in forensic science: understanding & utilizing the human element



U.S. initiatives to strengthen forensic science & international standards in forensic DNA

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- This review article covers recent U.S. activities to strengthen forensic science including the formation of the National Commission on Forensic Science and the Organization of Scientific Area Committees
- DNA documentary standards and guidelines from organizations around the world are also included

Review of DNA Documentary Standards and Guidelines

Table 8

Summary of available documentary standards and guidelines on forensic DNA. If an earlier version of a document has been superseded, then only the latest version (as of April 2015) is noted.

Source (date)	Document title	Reference
DNA Advisory Board (1998/1999)	FBI Quality Assurance Standards (QAS) for forensic and databasing laboratories	[29,30]
SWGAM (2011)	Revised FBI QAS for forensic and databasing laboratories and accompanying audit documents	[82]
SWGAM (2010)	Interpretation guidelines for autosomal STR typing by forensic DNA testing laboratories	[83]
SWGAM (2012)	Validation guidelines for DNA analysis methods	[84]
SWGAM (2013)	Interpretation guidelines for mitochondrial DNA analysis by forensic DNA testing laboratories and mitochondrial DNA nomenclature examples document	[85,86]
SWGAM (2013)	Training guidelines	[87]
SWGAM (2014)	Guidelines for missing persons casework	[88]
SWGAM (2014)	Interpretation guidelines for Y-chromosome STR typing	[89]
SWGAM (2014)	Guidelines for STR enhanced detection methods	[90]
SWGAM (2015)	Guidelines for the collection and serological examination of biological evidence	[91]
ENFSI DNA WG (2010)	Recommended minimum criteria for the validation of various aspects of the DNA profiling process	[92]
ENFSI DNA WG (2010)	Training DNA staff: concept training document	[93]
ENFSI DNA WG (2010)	Contamination prevention guidelines	[94]
ENFSI DNA WG (2014)	DNA database management: review and recommendations	[95]
Interpol (2009)	Interpol handbook on DNA data exchange and practice	[96]
NIST/NIJ (2013)	Biological evidence preservation handbook: best practices for evidence handlers	[97]
UK Forensic Regulator (2012)	The interpretation of DNA evidence	[98]
UK Forensic Regulator (2014)	Forensic science providers: codes of practice and conduct	[99]
UK Forensic Regulator (2014)	DNA analysis: codes of practice and conduct	[100]
UK Forensic Regulator (2014)	Allele frequency databases and reporting guidance for the DNA-17 profiling	[101]
UK Forensic Regulator (2014)	DNA contamination detection—the management and use of staff elimination DNA databases	[102]
UK Forensic Regulator (2014)	Forensic science providers: validation	[103]
IFSA (2014)	Minimum requirements for DNA collection, analysis, and interpretation: a document for emerging laboratories	[104]

Butler, J.M. (2015) U.S. initiatives to strengthen forensic science & international standards in forensic DNA. *FSI Genetics* (volume 18, in press)

FSI Genetics is the #1 Journal in the Forensic Science & Legal Medicine Category

Rank	Journal	2014 Impact Factor
1	<i>Forensic Science International: Genetics</i>	4.604
2	<i>International Journal of Legal Medicine</i>	2.714
3	<i>Forensic Science International</i>	2.140
4	<i>Regulatory Toxicology and Pharmacology</i>	2.031
5	<i>Forensic Science, Medicine, & Pathology</i>	1.983
6	<i>Science & Justice</i>	1.417
7	<i>Legal Medicine</i>	1.238
8	<i>Journal of Forensic Sciences</i>	1.160

Impact Factors have improved over the years for FSI Genetics

2008: 1.367
2009: 2.421
2010: 2.877

2011: 3.082
2012: 3.861
2013: 3.202

FSI Genetics Special Issue (Vol. 18, September 2015)

Author(s)	Article Title (Invited Review Articles)
John Butler	U.S. initiatives to strengthen forensic science & international standards in forensic DNA
Titia Sijen	Molecular approaches for forensic cell type identification : on mRNA, miRNA, DNA methylation, and microbial markers
Manfred Kayser	Forensic DNA phenotyping : predicting human appearance from crime scene material for investigative purposes
Chris Phillips	Forensic genetic analysis of bio-geographical ancestry
Robin Cotton & Matthew Fisher	Properties of sperm and seminal fluid , informed by research on reproduction and contraception
Claus Børsting & Niels Morling	<u>Next generation sequencing</u> and its applications in forensic genetics
Erica Romsos & Peter Vallone	Rapid PCR of STR markers : applications to human identification
Peter Gill et al.	Genotyping and interpretation of STR-DNA : low-template, mixtures and database matches – 20 years of research and development
K. Gettings et al.	<u>STR allele sequence variation</u> : current knowledge and future issues
Just, Irwin, Parson	Mitochondrial DNA heteroplasmy in the emerging field of <u>massively parallel sequencing</u>
Toni Diegoli	Forensic typing of short tandem repeat markers on the X and Y chromosomes
Ogden & Linacre	Wildlife forensic science : a review of genetic geographic origin assignment
Maria Brión et al.	<u>Massive parallel sequencing</u> applied to the molecular autopsy in sudden cardiac death in the young

ISFG Meeting (August 29-Sept 5, 2015)

<http://www.isfg2015.org>



- **10 Educational Workshops**

(1) Basic STR Interpretation, (2) EMPOP Advanced Practical Course, (3) Next Generation Sequencing, (4) Beyond DNA Profiling: RNA, Transfer, and Persistence, (5) Interpretation of Complex DNA Profiles Using LRmix Studio and EuroForMix, (6) Kinship Analysis, (7) The New YHRD, (8) Ethical, Legal, and Social Issues in Forensic Genetics, (9) Forensic DNA Phenotyping, and (10) Interpretation of Complex DNA Profiles Using STRmix

- **6 Plenary Lectures** by Peter Gill, Bruce Weir, Chris Tyler-Smith, Manel Esteller, Robin Williams, and Tomasz Grzybowski

- **57 oral presentations and >300 posters**

- SWGDAM participants speaking: Katherine Gettings, Tamyra Moretti, Jack Ballantyne, John Butler, Doug Hares, Mike Coble, Jodi Irwin, Peter Vallone, Lutz Roewer, Jo-Anne Bright, John Buckleton

Dr. Wilmer Souder: Early Handwriting Expert



Wilmer Souder in his NBS laboratory around 1934



Souder's notebooks documenting his involvement in handwriting cases between 1929 and 1950

- **National Bureau of Standards*** (1911-1913, 1917-1954)
 - His PhD research at the University of Chicago 1913-1916 on the photoelectric effect led to Robert Millikan receiving the 1923 Nobel Prize in Physics
- Chief of the NBS Identification Laboratory (est. ~1921) and Dental Research Laboratory (est. 1919)
- **Based on notebook records recently rediscovered, he served as a Federal expert in hundreds of handwriting, typewriter and ballistic identification cases during the 1920s through the 1950s**
- **Helped set up the FBI Laboratory in 1932** and provided training to the FBI and other forensic labs in document examination and ballistics
- Testified for the prosecution in the Bruno Hauptmann (Charles Lindberg baby kidnapping) trial in 1935
- Active member of IAI and IACP and many other scientific organizations

*NBS changed its name to NIST in 1988



Wisdom of Wilmer Souder

National Bureau of Standards (1911-1913, 1917-1954)

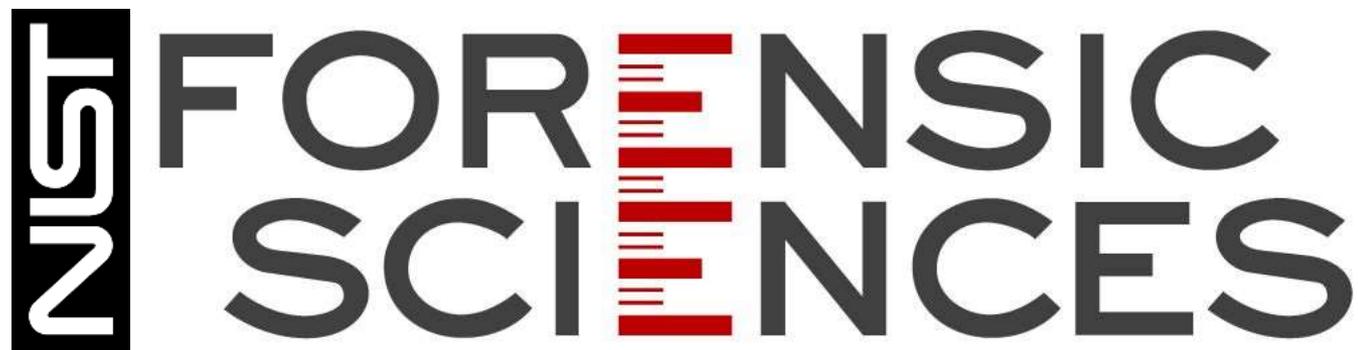
“The honest expert never looks upon the outcome of his work as a result of luck, the reward of a game, or victory in a battle of wits. He has built his qualifications through hard work. He establishes his conclusions through exacting procedures; he presents his testimony in the face of keen opposition and asks no favor beyond an honest consideration of the facts disclosed. Having done so, he has fulfilled the high obligations of his profession.

“Justice is sometimes pictured as blindfolded. However, scientific evidence usually pierces the mask.”

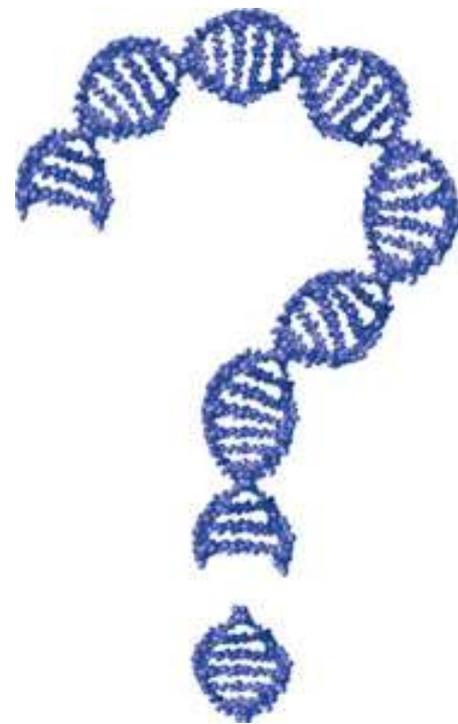
- **Wilmer Souder**, “Effective Testimony for Scientific Witnesses”, *Science* (1954) 119: 819-822

National Commission on Forensic Science (NCFS):
www.justice.gov/ncfs

Organization of Scientific Area Committees (OSAC):
www.nist.gov/forensics/osac/index.cfm



www.nist.gov/forensics



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